Insights

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Public domain version of BFOLDS software now available

By Lisa J. Buse

The *Boreal Forest Landscape Dynamics Simulator*, known as BFOLDS, is a PC-based simulation model designed to allow users to explore possible boreal forest fire regimes and forest succession patterns, as well as their interactions, over large areas (millions of hectares) and long time periods (centuries).

"Used in research and forest policy development in MNR for the past few years, the model has now been packaged, tested, and released as a user-friendly software tool, complete with graphic user interface and detailed documentation," says Ajith Perera, the OFRI researcher who led the BFOLDS development team.

"This tool allows users to explore and gain a greater understanding of the effects of various assumptions about processes of fire and succession on simulated fire regime scenarios," he continues. "This understanding of how forest landscape dynamics vary over space and in time can be used to support forest policy development and strategic land use planning efforts."

Perera points out that understanding large-scale natural disturbances, in particular forest fires, is important because fire is the major driver of the post-glacial boreal forest. "To understand the landscape ecology of this forest, we must understand how the fire regime varies in time and space and how the forest system responds. As well, in attempting to emulate these disturbances, resource managers must try to understand the potential natural variation in fire disturbance regimes. For these purposes, we need to characterize fire regimes in terms of, for example, frequency, return interval, and severity."

Traditionally, understanding of disturbance regimes was gained by looking at past disturbances. However, historical data provide a limited view (small areas, limited time frames, one outcome of many possibilities) and thus do not provide insight into the variability of natural disturbance regimes. As Hamish Kimmins, Canada Research Chair for Modelling the Sustainability of Forest Ecosystems at the University of British Columbia (UBC), recently stated, "Using this approach to understand what could happen is akin to looking in the rear-view mirror while driving forward."

BFOLDS is a *simulation* model; thus, it uses knowledge of the basic principles of forest fire

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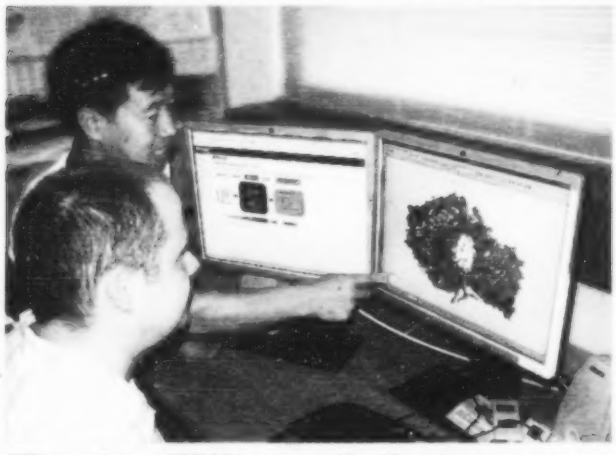

Photo: Trudy Vaittinen, OFRI

OFRI researchers use BFOLDS to study boreal forest fire regimes.

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Ontario

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processes and forest succession to predict *potential* rather than show past disturbance dynamics. This approach allows interactive exploration of multiple *what if* scenarios, under various assumptions of weather, forest vegetation, and other variables, and offers insight into potential variability and the probabilistic nature of forest fires regimes.

Thus, BFOLDS supports a better understanding of these regimes. To simulate the probabilistic characteristics of long-term fire regime and forest cover changes, it uses a combination of:

- Spatial information about forest landscape composition, fire weather, geo-climate, terrain, and soil
- Up-to-date scientific and expert knowledge of forest fire processes and forest succession

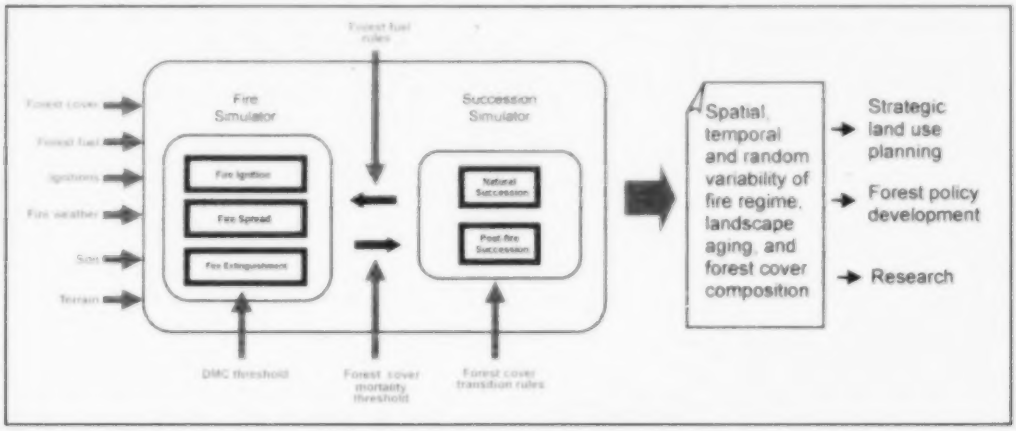
(See below diagram showing BFOLDS' required inputs and its components, outputs, and general applications.)

Perera cautions that BFOLDS is *not* meant to be used to produce deterministic information, such as a map of forest cover composition in a given year, or to investigate fine-scale processes, such as the behaviour of individual forest fire events or changes in the composition of a single forest stand.

To learn more about BFOLDS, contact OFRI, information.ofri@ontario.ca, (705)946-2981, ext. 271 and request *BFOLDS 1.0: A Spatial Simulation Model for Exploring Large Scale Fire Regimes and Succession in Boreal Forest Landscapes* (Forest Research Report 152). Please specify electronic (PDF) or paper.

This report documents the science behind the model and the required user assumptions and data. It will help potential users understand how the model works and what it can be used for.

To access the software and its documentation, visit www.fire-regime-model.com. If you intend to use BFOLDS or have a technical question, please e-mail flep@ontario.ca.



An overview of the BFOLDS model, including required inputs, model components, and possible outputs and intended applications.

Southern Ontario report

Save the butternut!

By Sarah Mislan, summer experience student

The butternut tree contributes to the biodiversity of southern Ontario forests and is a highly nutritious food source for several animal species. However, the butternut is endangered, due in large part to an invasive alien fungal disease called *butternut canker*, which attacks and kills butternut trees of all ages and sizes. Butternut has disappeared in many parts of the United States and is under threat in Ontario, Quebec, and New Brunswick. Here in Ontario the long-term goal is to restore butternut and its function in the forest. A key strategy will be to identify and re-introduce disease-tolerant butternut across southern Ontario.

At OFRI, researchers John McLaughlin, Glenna Halicki Hayden, and Sylvia Greifenhagen have teamed up with the Butternut Recovery Team, Purdue University,

Photo: Sylvia Greifenhagen, OFRI

Summer experience student Elizabeth Lu inoculates a butternut tree with the fungus that causes butternut canker as part of a test of inoculation methods.

and MNR's Forest Health and Silviculture Section to create a recovery strategy for butternut. "This project is vital to keep butternut on the landscape and to save it from extinction," Halicki Hayden says.

OFRI has an important role in the project: developing protocols for testing butternut DNA for purity and testing for disease resistance in the greenhouse. "We need to make sure that we are working with pure butternut, as it tends to hybridize with other species," Greifenhagen explains. "Once we are sure of that, we can test various families to try to find those that have some ability to resist the canker disease."

The researchers have been extracting and deciphering DNA to identify pure butternut vs. hybrids. With intentions to produce results from the project in 2009, they say they face constant challenges. "We are making good progress; however, the protocols aren't quite finalized," Halicki Hayden says. "And we need to do a lot more testing before we are confident in our results."

Want to learn more? Contact John McLaughlin at (705)946-7419, john.mclaughlin@ontario.ca.

Red oak outgrows sugar maple in shelterwood field experiment

By Sarah Mislan, summer experience student

In 1993, former OFRI research scientist Dan Dey established a field study to examine the effects of shelterwood overstory density and prescribed fire on regeneration of red oak and sugar maple. Red oak is a highly valued species in southern Ontario, but it is often outcompeted and replaced by sugar maple and other shade-tolerant tree species.

"This species is not only important economically but also ecologically," asserts OFRI research scientist Bill Parker, Dey's partner on this study. "Red oak is one of the most important oak species in Ontario. Economically, its wood is prized for its appearance and physical properties and is used for timber production in North America. Ecologically, the acorns produced by red oak are a food source for birds and other wildlife."

He continues, "Fire is believed to have played a major role in the development and persistence of Ontario's red oak forests before European settlement. So we wanted to see if we could successfully replicate the benefits of fire using shelterwoods and prescribed burning."

Dey and Parker believed that the higher light levels beneath shelterwoods would enhance photosynthesis of red oak over maple, but they wanted scientific proof. Their findings: The removal of the small, inferior non-oak trees to create a more open overstory canopy did favour photosynthetic potential of red oak over sugar maple. The study, which is unique to Ontario, is promising because it will offer new information to be included into silviculture guide revisions and eventually to improve red oak regeneration in Ontario.

Want to learn more? Send an e-mail to information.ofri@ontario.ca or call the OFRI publication request line at (705)946-2981, ext. 271, and ask for a reprint of the article *Influence of Overstory Density on Ecophysiology of Red Oak* (Quercus rubra) *and Sugar Maple* (Acer saccharum) *Seedlings in Central Ontario Shelterwoods*, which appeared in the journal *Tree Physiology*. Please specify electronic (PDF) or paper.

Thinning and underplanting foster natural succession in southern Ontario conifer plantations

By Abigail M. Obenchain

Red pine plantations are common across southern Ontario, and while some criticize these forests for being "unnatural," others see all the economic, ecological, and recreational benefits they offer to the millions of people who live nearby.

In addition to appreciating the benefits they bring today, OFRI research scientist Bill Parker finds the story behind these plantations fascinating and says it underscores how important plantations can be to ecological restoration.

"By the late 19th century, much of the forest cover in southern Ontario had been removed," he explains. "In areas with glacial outwash soils, attempts to farm the cleared land resulted in the loss of topsoil and the creation of desert-like wastelands that covered 30 hectares or more. These sites were known as the blowsand areas. Many people don't realize that at one time in the not-too-distant past, we had areas that were essentially deserts in southern Ontario."

He continues, "Beginning in the 1920s, however, the government began encouraging the planting of red pine because it can grow well on infertile, well-drained soils. As the years passed and the trees grew, the soil improved, and the developing understory fostered the natural establishment and growth of other species of trees and plants that provided food and habitat for wildlife. In other words, these plantations brought these desolate blowsand areas back to life."

Photos: MNR

Yesterday's desolate blowsand areas are thriving forests today, thanks to conifer plantations. New research results will help forest managers convert these plantations back to a more natural forest.

As the plantations matured, however, harvesting of the red pine began, and some plantations began to lose mature trees due to root rot and other factors. In 1994, a group of researchers led by former OFRI research scientist Dan Dey but including Parker began investigating how best to manage these plantations to ensure that as the red pine was harvested or died, the new forest that developed would be as close as possible to "natural" forest, the type that grew before European settlement. Specifically, they were looking at best practices for thinning and underplanting to promote natural succession.

"As a result of our study of best practices for ensuring successful natural succession, we have learned that underplanting and earlier, heavier thinning can help establish a healthy understory of desired tree species while still providing economic benefits through harvesting."

He and his fellow researchers, MNR's Ken Elliott and Eric Boysen, as well as Dey, have provided a detailed description of the history of these red pine plantations, their research results, and their management recommendations in a *Forestry Chronicle* paper entitled *Restoring Southern Ontario Forests by Managing Succession in Conifer Plantations*. To get a copy of this paper, e-mail information.ofri@ontario.ca or call (705)946-2981, ext. 271. Please specify electronic (PDF) or paper.

Another *Forestry Chronicle* article that details results from this project is *Managing Succession in Conifer Plantations: Converting Young Red Pine Plantations to Native Forest Types by Thinning And Underplanting* (2001). It is also available from OFRI.

Was widespread boreal conifer frost damage in spring 2007 due to climate change?

By Sarah Mislan, summer experience student

In the spring of 2007, huge areas of young conifers (both planted and natural) in northeastern Ontario experienced needle and bud damage prior to budbreak.

Foresters in the area were concerned. Was this a typical random event or was it related to climate change? OFRI research scientist Rongzhou Man and several colleagues with expertise in boreal silviculture, tree physiology, and climate change decided to investigate.

The researchers looked at the cold hardiness patterns of the affected conifer species, the thermal requirements needed for trees to begin growth, the changes in temperature patterns gleaned from the historic weather data sets, and the cold nights that occurred in late May 2007. The data support the hypothesis that that warmer-than-usual temperatures in early and mid-May caused earlier growth and break bud, subjecting trees to the cold later in the month when temperatures dipped below -8 degrees C.

Photo: Jim Rice, OFRI

In spring 2007, many conifers in northeastern Ontario were hit hard by frost damage. OFRI research scientist Rongzhou Man (far left) suspects climate change was a key factor.

"If the trend in climate change continues, with trees starting growth earlier each year, the frequency and possibly the severity of frost damage will likely increase," Man says. "Widespread damage will affect the productivity and health of the trees and the forests they live in."

To prevent such damage, Man recommends increasing the use of alternative management approaches including the increased use of shelterwood systems in these stands. The environmental conditions under tree canopies are less extreme, therefore providing protection from frost damage.

Working with Man on this study were OFRI's Steve Colombo and Jim Rice, Gord Kayahara of MNR's Northeast Science and Information, and Lakehead University's Qinglai Dang.

Want to learn more? E-mail information.ofri@ontario.ca or call the OFRI publication request line at (705)946-2981, ext. 271 and ask for *Frost Damage: Consequences of Climate Change?*, available in late 2008.

OFRI researchers spell out the facts and fantasies about harvesting and carbon storage

By Abigail M. Obenchain

Over the past several months, many articles in the popular media have left readers with the impression that harvesting boreal forests releases greenhouse gases and contributes to climate change. However, OFRI's three carbon budget modelling researchers – Michael Ter-Mikaelian, Steve Colombo, and Jiaxin Chen – have strong evidence to the contrary. To foster a more informed discussion about harvesting and carbon storage, they decided to present their findings as well as debunk these misconceptions in a *Forestry Chronicle* article entitled *Fact and Fantasy About Forest Carbon*.

"Our research results, which stem from a model that we entitled FORCARB-ON [based on FORCARB2, a USDA Forest Service model], project that sustainable forest management will continue to make Ontario's forests a carbon sink through the end of the century, especially when you take into account the fact that every tonne of wood product is made of half a tonne of carbon taken from the atmosphere," Chen reports.

He points out that when forests are harvested, relatively little carbon is released. The fibre and thus the carbon are captured in wood and paper products. "What some people don't take into account is that these products can persist and store carbon for many years – even decades in the case of construction materials and furniture. Paper products are usually recycled, and if they are thrown away, they often decay very slowly due to the anaerobic conditions in most landfills."

Ter-Mikaelian adds that the advantage of capturing tree carbon through harvesting and producing wood products is compounded by the fact that in the long run you get more storage by harvesting some of your stands and letting them regrow, rather than letting all stands become old.

"Old stands in northern forests are just about carbon neutral, meaning they release as much carbon as they are absorbing," he says. "Some old trees will eventually begin to decline and decay or may burn in a forest fire. Both decay and burning result in significant emissions of greenhouse gases. Harvesting allows the carbon in wood to be stored for long periods of time, rather than returning to the atmosphere as the tree dies."

Colombo points out that using wood has other benefits that help address climate change. "If we weren't using wood for construction, for example, builders would have to turn to concrete or steel, production of which causes considerably more greenhouse gas emissions than harvesting does."

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He adds that we are always going to need wood products – and if these products don't come from Ontario, where sustainable forest management is the law, some consumers might unknowingly use wood from countries where deforestation is contributing to climate change. In Ontario's managed forests, successful regeneration is the expected goal, and as the new trees grow, a new cycle of capturing carbon begins.

Colombo also asserts that forest industry needs to find ways to harvest, transport, and manufacture wood products using less fossil fuel, even though such emissions do not negate the large carbon storage gained through capture in harvested wood.

Making use of wood headed for or in landfills is also important. Colombo says, "It is better to reuse wood than to put it in the landfill, and one of those uses might be burning it to generate energy instead of burning fossil fuel. You can either burn the wood directly by diverting wood from landfills to a power generation plant, or you can capture the methane produced by wood as it decomposes in a landfill and burn that for energy."

In the view of all three researchers, understanding and improving all aspects of the forest and the wood products life cycle are important to reducing climate change.

For a reprint of *Fact and Fantasy About Forest Carbon*, e-mail information.ofri@ontario.ca or call (705)946-2981, ext. 271. Please specify paper or PDF. Also available from OFRI: *Future Carbon Storage in Harvested Wood Products From Ontario's Crown Forests*, a *Canadian Journal of Forest Research* article by the same authors as well as Linda Heath of the USDA Forest Service.

The OFRI Arboretum: Growing research success since 1989

By Sarah Mislan, summer experience student

As the OFRI arboretum approaches its 20th year, it continues to offer a unique advantage to MNR researchers in Sault Ste. Marie. With 95 hectares of land and a prime site within the city limits, the arboretum is a convenient location for farm-field type experiments close to researchers' home base at OFRI.

According to OFRI facilities coordinator Randy Fawcett, the arboretum was established in 1989. Spearheaded mainly by former OFRI staff Dennis Gamble, George Buchert, and Terry Taylor, it provides an intermediary between the greenhouse and the field for research trials and is used for maintaining genetic archives (see *Insights* Vol. 7, No. 2 for more about these archives).

"The location was ideal for many reasons: It's close to OFRI, has ready access to water for irrigation, and most important, has four different soil types, including sandy loam, clay loam, sand, and clay," Fawcett emphasizes. "It offers the opportunity to test how trees respond to a range of treatments and sites."

Denzil Irving, a former OFRI research technician who has stayed involved with maintaining the arboretum and trials established there, adds, "Conducting experiments at the arboretum provides a significant advantage to researchers. It gives them more control over their experiments than they would have in the bush."

Over the years, the arboretum has been home to many trials, ranging from assessing seedling stock quality to studying tree responses to vegetation management alternatives to testing the survival and growth of trees from various seed sources.

Today the focus of research trials at the arboretum ranges from growing Canada yew as a crop to testing hybrid poplar clones. Read on for more about two of these projects.

Blister rust resistant white pine: One exciting project underway at the OFRI arboretum focuses on white pine blister rust resistance. In the early 1900s, this disease was brought from Europe to North America on infected seedlings. Because this disease is not native to North America, five-needled pines succumbed quickly to it. "Our white pine trees were never forced to develop mechanisms to protect themselves from the disease," asserts Darren Derbowka, OFRI genetics project forester.

Photo: OFRI

The OFRI Arboretum has been home to a variety of forest research experiments over the past 18 years, including one that focused on how several woody and herbaceous plant species compete with young crop trees. In this experiment, the fireweed grown on the clay portion of the research site (shown in this photo) turned out to a serious problem, as it passed on a fungal disease that killed all the jack pine.

OFRI's journey to find white pine that could fight the disease began in 1947 due to a researcher named Carl Heimburger. Derbowka explains that Heimburger "wanted to search for resistant trees that were native to North America. He found that trees in Quebec showed signs of resistance and were able to survive where blister rust was a known hazard."

Heimburger also collected material from white pine trees in a genetic archive in Maple, Ontario and tested them for resistance. He noted that trees from Europe had greater resistance to the rust and began extracting pollen from these resistant trees in controlled breeding areas. By successive breeding between the native trees and the European variety, Heimburger was able to produce blister rust resistant seedlings.

Heimburger used the pedigree system, which allowed him to keep track of which families were resistant. Since 2000, advanced generations of these hybrids have been tested and also found to be resistant.

In 2000, OFRI research scientist Pengxin Lu picked up where Heimburger and others left off. He and his team have developed what they hope are blister rust resistant hybrids and are field testing them at the OFRI Arboretum and other sites in central and southern Ontario. Lu says the arboretum is ideal for field testing because it gives researchers control over the plots to some degree and offers conditions similar to

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that in which trees would normally grow. To learn more, contact Darren Derbowka at (705)946-7431, darren.derbowka@ontario.ca.

Canada yew for paclitaxel products: Another project underway at the arboretum focuses on Canada yew. This common Northern Ontario shrub provides a supply of paclitaxel, a chemical used to make one of the most valuable cancer drugs in the world. Researchers are hopeful that ongoing studies of the yew will provide a sustainable supply of paclitaxel.

Tom Noland, a tree biochemistry scientist with OFRI, explains, "Paclitaxel is used to make Taxol®, one of the best-selling chemotherapy drugs in the world, with almost US $1 billion in annual sales. Taxol® is used to fight breast and ovarian cancer and certain types of lung cancer."

However, it takes several tonnes of yew foliage to produce a small amount of paclitaxel. Noland says, "Due to its complex chemical structure, paclitaxel is difficult and expensive to synthesize, so it is more economical to extract it from natural sources."

Most of the work will be finished within a year; however, the process is slow. It takes a year to propagate yew and two to four years to get enough stock to start plantations. Elite material, which is yew that grows quickly and has the highest paclitaxel concentrations, can take even longer to produce.

In addition to seeking out and producing trees that yield high amounts of paclitaxel, Noland and his colleagues are investigating how best to harvest Canada yew foliage and what growing conditions are ideal. For example, what soil type do these shrubs prefer, and how close together should they be planted?

To date, Noland has learned that yew plants that received compost, fertilizer, and compost plus mulch treatments grew significantly better than those in the unfertilized unmulched control plot. Once he and his collaborators are done collecting and analyzing their data, Noland will be able to recommend which growing conditions result in the highest amounts of paclitaxel. He adds that having the arboretum as a testing site has been very useful because it is close to his home base at OFRI and gives him more control over growing conditions than in a natural forest.

To learn more, contact Tom Noland at (705)946-7421, tom.noland@ontario.ca.

Why produce research publications?

By Lisa J. Buse

"What do you mean you have 10 new climate change reports? I want to know about *biodiversity*!"

For resource managers who prefer face-to-face transfer and need immediate answers to specific concerns or issues, the latest research publications may seem unhelpful, especially if the information relates to questions that were a high priority five years ago and are now on the back burner – or that haven't even been asked yet. So why do researchers produce all those publications anyway?

- **To ensure quality and scientific validity:** Before a researcher can hand results off to a user, he must make sure they pass scientific muster in the form of peer review of results documented in the form of publications. The premise is that if someone else did the work in the same way, he or she would obtain the same results. Peer review helps to ensure that users can apply new research information with confidence.

- **To share knowledge widely:** Most people prefer face-to-face transfer, for example, workshops, extension visits, or field tours. However, these methods are not always possible or practical, especially given that research clients far outnumber researchers. Publications are a cost-effective way to get new information out to many users in a consistent manner and not just Ontario clients but also the national and international research community and practitioners in other areas with similar forest types.

- **To ensure new information is permanently documented and accessible:** Publications ensure that the research results are available to users well beyond a researcher's tenure with the organization. While it's great to get information directly from the researcher during a field tour, if the results are not peer reviewed and documented in a paper or report, that information may be lost when the researcher moves on. And reports tied to workshops and training sessions can serve as helpful reference tools, so participants can refer back and so those who could not attend can access the information.

- **To allow researchers' to build on the work of those who came before them:** Meaningful results, especially in boreal forests (which have long rotations), may take years or even decades and span more than one researcher's career. Documenting activities, methods, and interim results in publications can allow others to pick up where the study originator left off. Researchers with OFRI's current white pine blister rust resistance project, for example, benefited greatly from being able to read about previous efforts in this area, some of which date back more than 50 years and thankfully were well documented.

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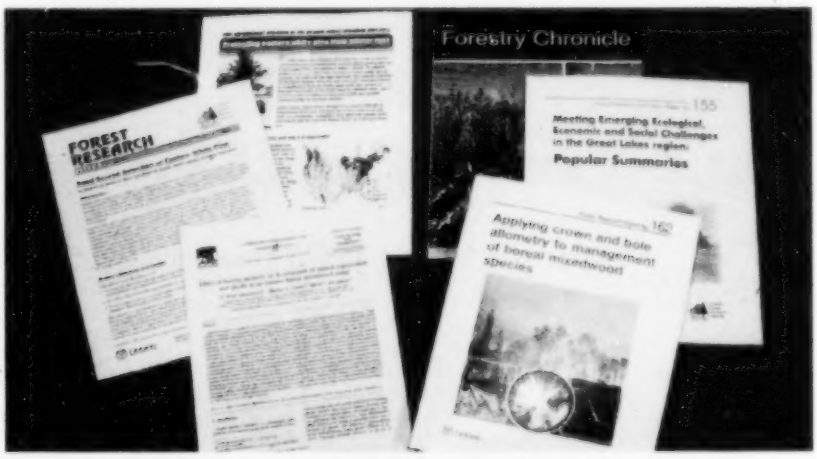

FOREST RESEARCH
Forestry Chronicle
Meeting Emerging Ecological, Economic and Social Challenges in the Great Lakes region
Popular Summaries
Applying crown and bole allometry to management of boreal mixedwood species

Photo: Trudy Vattimen, OFRI

OFRI has three publication series: Forest Research Reports, Forest Research Information Papers, and Forest Research Notes. OFRI staff also publish their work in a range of scientific journals and have been involved in coordinating special issues on subjects such as vegetation management, natural disturbance emulation, and the Canadian Ecology Centre-Forest Research Partnership.

How can resource managers make use of research publications?

- To learn about past and current research results related to a specific issue or concern
- To ensure that policies, guides, planning, etc., are based on the best available peer-reviewed science
- To analyze what we *don't* know and where future research efforts should focus (and to make sure that new research is not "reinventing the wheel")
- To look back at a workshop or conference to see what was presented and/or what the outcomes of discussions were and whether the yardsticks have moved ahead in the interim
- To determine how knowledge of and the approach to an issue has evolved over time

If you're looking for the answer to a specific question, research publications in and of themselves may not be that helpful unless you're willing to spend the time to think about the information presented, synthesize it, and figure out how to apply it to your problem or issue. However, referring to research publications will be more helpful than trying to sort through raw data, unsynthesized information, or undocumented results.

With many resource management issues, the trick is in developing and applying the best knowledge for a balanced solution in any given situation. Research publications will help but are only one part of the solution – don't look to them for specific answers but rather greater understanding and perspective.

And what about the problem of publications on a given issue coming out after resource managers' attention has moved elsewhere – or before the issue has hit their radar screen?

Well, that's a problem that has no easy answer. Forest research can't be stopped and started on a dime. However, what can and has worked is having research teams that include both researchers and research users who are working closely together to ensure the right questions are investigated and that interim results are communicated quickly.

Expert scientific opinion can provide a temporary bridge that hopefully is headed in the right direction, but it's the peer-reviewed science that provides a permanent foundation for sustainable forest management.

What do we know about harvesting forest biomass for energy?

By Abigail M. Obenchain

Last February, 140 people from Ontario to Nepal came together at the University of Toronto for a workshop entitled *The Scientific Foundation for Sustainable Forest Biomass Harvesting Guidelines and Policies*.

According to Dan Puddister, a science coordinator with OFRI and an organizer of this event, the goal was to enable government and university researchers, government regulators, industry, and non-government environmental organizations to share knowledge about the effects of removing biomass on forest ecosystems, to identify priorities for research needed to develop guidelines and policies, and to set up a national forest biomass network.

He notes, "Today, many people in Ontario and around the world are seeking alternatives to fossil fuels, the burning of which has caused significant changes in carbon dioxide levels since the industrial revolution began. Forest biomass harvesting and management present a sustainable alternative to fossil fuel use and are considered to be carbon neutral. Sustainable forest biomass harvesting fits within the goals of protecting ecological integrity and biodiversity, which are key requirements of Ontario's forest management planning system."

Photo: MNR

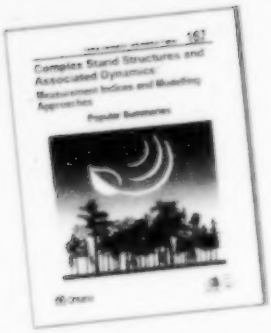
Forest biomass may be a source of renewable energy, but many questions remain about how to ensure sustainable use.

OFRI research scientist Tom Noland also attended the workshop and reports: "Nearly all the workshop participants agreed that sustainable forest biomass harvesting has a place in Canada. If not done carefully, biomass harvesting has the potential to affect biodiversity and forest productivity, but the impacts can be mitigated and minimized through good forest management practices, effective monitoring, and active adaptive management."

Noland points out that forest biomass may be a source of valuable chemicals as well as energy, and these chemicals could provide significant economic development opportunities and replace some chemicals derived from petroleum.

Several publications related to this event are available on the Sustainable Forest Management Network website, including two summaries of ongoing Canadian research, one on biomass harvesting and site productivity and another on biomass harvesting and biodiversity (compiled by OFRI's Elaine Mallory; other MNR research contributors to this workshop were OFRI's Wayne Bell and Dave Morris of the Centre for Northern Forest Ecosystem Research). Also posted are notes from the workshop discussions. To download these publications, go to www.sfmnetwork.ca and click on *Events* and *Previous Workshops*, page down to the biomass workshop section, and click on *Results From This Workshop Can Be Found Here*.

Many organizations besides MNR were involved in this workshop; for a complete list, see the workshop announcement (also posted on the events page at www.sfmnetwork.ca).



Report reveals the latest on modelling complex stands

By Abigail M. Obenchain

Creating and maintaining forest stand complexity has become an international trend. While simpler stands (single species, even-aged) are easier to manage and model, complex stands are increasingly more common on the landscape. This complexity poses challenges for forest managers and modellers.

To address some of these challenges, about 100 forest scientists and researchers from as far as Australia and Europe were in Sault Ste. Marie in summer 2007 for an International Union of Forest Research Organizations (IUFRO) conference. Co-hosted by the Canadian Forest Service (CFS) and OFRI, the conference was entitled *Complex Stand Structures and Associated Dynamics: Measurement Indices and Modelling Approaches*. CFS's Peter Newton was the main organizer of the conference, which allowed participants to assess the current state of knowledge, share successes, and compare various measurement and modelling approaches.

"It was a timely conference that allowed natural resource enthusiasts to come together and share their knowledge," said Michael Ter-Mikaelian, OFRI research scientist and conference organizer. "Forests are always changing, and we need to be able to project these changes so we know the volume of wood a forest will produce. Developing models that can simulate dynamics of complex stand structures will better represent short- and long-term tree and stand development."

"The conference went really well," said Mahadev Sharma, also an OFRI research scientist and conference organizer. "It provided an opportunity for experts from around the world to present and discuss the current state of knowledge and to learn about forest management in Ontario."

To order the popular summaries report for this conference (Forest Research Information Paper No. 167), e-mail information.ofri@ontario.ca or call (705)946-2981, ext. 271. Please specify electronic (PDF) or paper.

Kemptville white pine blister rust resistance trial
Essai de résistance à la rouille vésiculeuse du pin blanc à Kemptville

Photo: Linda Touzin, MNR

New signs alert forest users to disease resistant white pine

By Abigail M. Obenchain

Field tours, workshop presentations, seminars, technical reports, displays, web pages ... forest researchers at OFRI use a myriad of ways to connect with key audiences and transfer new knowledge to those who manage Ontario's forests.

OFRI's genetics researchers, led by research scientist Pengxin Lu and forester Darren Derbowka, have decided to use colourful bilingual signs at sites near Kemptville, Huntsville, and Midhurst to reach out to others who use the land on which they've outplanted white pine seedlings that show resistance to blister rust.

They hope to inform passers-by about developments in fighting this devastating invasive alien disease, which over the past century has contributed to a massive decline in eastern white pine and related pines across North America. Since blister rust and North American white pines evolved in isolation of one another, selective pressures in favour of rust-resistance mechanisms to the disease failed to occur. As a result, resistance never developed, and this disease now causes high mortality in many of these species, with close to 100 percent of affected trees dying in some young plantations.

"We have used traditional breeding techniques to produce trees that can resist blister rust," Lu explains. "We crossed eastern white pine with related five-needled pines from Europe and Asia, where the disease originated, and then backcrossed the resulting hybrids with eastern white pine to produce a new generation that genetically is more than 90 percent eastern white pine but has traits for resistance to blister rust."

He continues, "We have conducted several years worth of successful greenhouse tests and are now field-testing resistant white pines at sites across this species' natural range in Ontario. We are optimistic that these trees will help us restore Ontario's provincial tree on sites where it used to grow but is disappearing due to blister rust."

For more information about the white pine blister rust resistance project, contact Lu, pengxin.lu@ontario.ca, (705)946-7415 or Derbowka, (705)946-7431, darren.derbowka@ontario.ca.

Internship at OFRI opens the door to a new world for forester from Nepal

By Krish Homagain

Editor's note: *OFRI staff have a strong commitment to mentoring future generations of resource professionals. Over the years, OFRI has hosted dozens of interns and summer students studying in a range of disciplines (forestry, chemistry, computer science, communications, etc.) and coming from locations as different as Ontario, France, and Nepal. These young people have gained real-world experience by working with OFRI staff for periods from two months to two years. Their supervisors strive to provide them with challenging assignments that allow them to develop new skills and knowledge, rather than just act as an extra pair of hands. Some of these students have gone on to successful careers within MNR, including OFRI chemical lab technologist and researcher Maara Packalen, who started at OFRI as a summer student in 1996. Below OFRI forester intern Krish Homagain, a native of Nepal, relates his recent experiences as a forester intern.*

In 2005, I migrated to Toronto from Nepal as a trained and experienced forestry professional. Initially I struggled to accommodate myself in my new country and in my profession as well. I remember when I was called for a telephone interview for an MNR assistant forester position in Manitouwadge. I had a hard time answering some of the Ontario-related questions!

I then contacted the Ontario Professional Foresters Association (OPFA) and OFRI to learn more about forestry in Ontario. I started to learn about the ministry and the forestry profession. I was interviewed twice for the MNR forester roster and was looking for a way to relocate to Northern Ontario. Finally I got the opportunity to work as a stem analysis project intern at OFRI and left Toronto's suffocation.

The objectives of my internship were to advance my knowledge of forest management in Ontario by working on research and transfer projects and to advance my knowledge about field and laboratory data collection methodologies, data management and analysis, and computer applications. I was expected to learn more about uncertainties in forest inventory, sampling design, stem analysis, volume and biomass estimation, and data management and analysis. I was also expected to learn about the impacts of intensifying silviculture on fibre production, floral diversity, and biomass (downed wood).

I have had the privilege of working on two interesting research projects:

1. *Developing and Evaluating Taper Equations for Plantation-Grown Jack Pine and Black Spruce Trees at Varying Stand Density* (led by OFRI's Mahadev Sharma): I have been heavily involved in analyzing tree stems – in the form of cross-sectional disks or *cookies* – to produce data for taper equations, which allow more accurate estimates of tree volume based on tree shape. To date, this work has included processing (cutting, drying and sanding), measuring, imaging (scanning), and analyzing the rings of more than 5,000 cookies. While working on this project, I have learned or enhanced my ability to operate a band saw, drum sander, and other power tools with three fundamental principles: safety, quality, and production. I have learned to maintain a safe workshop and lab work environment without compromising the quality of work. And I learned WinDENDRO™, a program for analyzing tree rings.

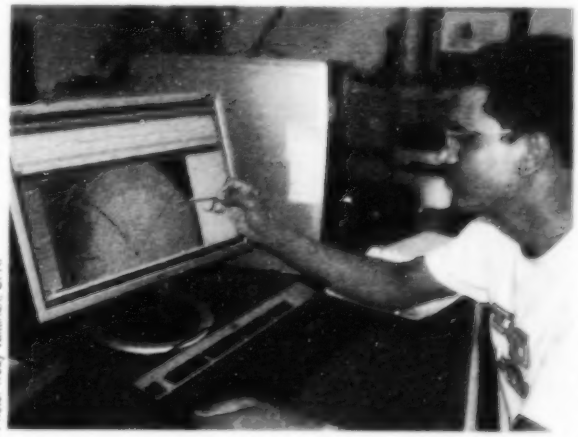


Photo: Trudy Vaittinen, OFRI

Forester intern Krish Homagain uses software to analyze tree discs in support of growth and yield research.

2. *Intensive Forest Management: NEBIE Plot Network* (led by OFRI's Wayne Bell): For about eight weeks in summer and fall 2007, I was a member of the research team studying the effects of a range of silvicultural intensities in several forest types across northern and central Ontario. I took a tour of northeastern Ontario, during which I learned more about the boreal and Great Lakes-St. Lawrence forest types, forest species composition, geology and geography, the forest industry, and the rationale for this plot network. I helped to plant trees, locate and lay out research plots, and collect growth and yield data and soil samples.

I had many interesting experiences in the bush. For example, I was surprised to see the large piles of wood and debris on the ground and more surprised to hear that most would be burned. In Nepal, people go into the forest and will take away even a small twig for firewood and forage for cattle bedding. There is no need for personal protective equipment, and they carry those loads on their backs. Sometimes, a bundle of firewood might be the source of money to buy their next supper.

While working in a swampy area of northern Ontario in the summer, I hardly saw more than five species of fauna (including black flies/mosquitoes) in one spot. I learned that none of the snakes is poisonous. Nepal has 89 species of snakes, and 21 of them are poisonous. Foresters in Nepal have to be equipped to handle encounters with not just snakes but also tigers and leopards.

In addition to working on these research projects, I had many opportunities for training, on subjects such as:

- Ontario forest legislation, policies, manuals, and guides; environmental assessments and forest management planning; forest health and silviculture; licensing wood allocation and measurement; independent forest audits; forest certification and reporting; forest compliance; and more
- The use of the *Strategic Forest Management Model* (SFMM), the *Natural Resources Values Information System* (NRVIS 3), and Forest Management Planning 2011
- Workshop, field, and general health and safety
- Hazardous materials and workplace discrimination/harassment as well as career planning, resume/cover letter writing, and interviewing skills.

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I also attended two international professional meetings, which allowed me to learn more about not just the scientific topics but also how new scientific information is disseminated. They were entitled *Complex Stand Structures and Associated Dynamics: Measurement Indices and Modelling Approaches*, held in Sault Ste. Marie, and *Scientific Foundation for Sustainable Forest Biomass Harvesting Guidelines and Policy*, held at the University of Toronto.

In addition, every month I have participated in online conference calls, which have allowed me to interact with forestry professionals working in the field across Ontario. I have also enjoyed attending the many natural resource management and science seminars held at OFRI over the fall, winter, and spring [contact information.ofri@ontario.ca for more about these].

It has been wonderful to have the opportunity to work for MNR and to learn more about forestry in Ontario, not to mention forest research. I am hopeful that my internship experience will help me have a long and productive career in northern Ontario. I may have been born in Nepal, but I have grown to love the magnificent and productive forests of northern Ontario and am grateful to have had the opportunity to enter this new world.

Q. Why is hydrology a key current research interest now that Ontario's Far North may be opened up to forest harvesting, hydroelectric power generation, and diamond mining?

A. OFRI forest soils and water research scientist Jim McLaughlin responds: "It is very important to understand hydrology – water flow paths and fluxes – if you want to ensure sustainability of ecosystems. It controls the chemical and biotic processes in forests and peatlands. Hydrology may be the most important process regulating how ecosystems function and develop. Hydrology influences landform development by regulating interactions among vegetation, nutrient cycling, cycling of trace metals such as mercury, and carbon cycling, all of which are interrelated.

"Some of the proposed management activities in the Far North, such as road construction, forest harvesting, hydroelectric power generation, and mining, can change the hydrology of forested and peatland landscapes, including how carbon, mercury, and nutrients are transported to streams and lakes, as well as how carbon cycles through forests and peatlands. Projected changes in climate could intensify these hydrologic changes.

"Creating hydroelectric reservoirs, for example, inundates forests and peatlands and can change anaerobic microbial processes, leading to significant increases in production of methylmercury, the toxic form of this element. Methylmercury can be taken up by microorganisms and phytoplankton, thereby entering the food chain.

"Mining activities can result in immediate fluxes of mercury from soil to streams and lakes, where it can again accumulate through the food chain. Draining peatlands for mining or any other management activity also increases soil organic matter decomposition and mercury release from soil. During periods of heavy rainfall, much of the mercury can be transported from the soil to streams and lakes.

"Currently, we have a poor understanding of how hydrology regulates mercury cycling and fluxes as well as nutrient and carbon cycling and fluxes in the Far North and how these respond to climate change and forest and peatland management. That's why several studies have been set up in the Far North to improve understanding of the interactions of management and climate change on hydrology and subsequent mercury, nutrient, and carbon cycling and fluxes.

"The bottom line is, to predict the effects of environmental change in the Far North, either direct, such as management, or indirect, such as climate change, we must understand how hydrological processes vary over time and across the landbase."

OFRI Research Trivia!

For clues to the answers of these questions, see the previous issue of Insights *(Vol. 8 No. 1), available on the publications page of OFRI's website (ontario.ca/ofri).*

1. **What is a stem profile model?**
   a. A sample of tree stem used to illustrate the varying extent of insect damage
   b. A mathematical epresentation of the shape of a given tree species' stem
   c. A diagram of a tree stem that depicts all physical anomalies such as burls, wounds, and fungal growths

2. **Researchers working on a study in the Nipissing Forest near North Bay, Ontario compared species composition data collected via aerial FRI photos and that collected via workers on the ground. How much of the time did the two sets of data agree?**
   a. 54 percent b. 79 percent c. 92 percent

3. **How many sustainability indicators did soil and water research scientist Jim McLaughlin provide input into during the preparation of MNR's 2006 state of the forest report?**
   a. eight b. five c. two

Answers: 1-b. These mathematical models allow for more precise calculation of timber volume and help to ensure that mills will get the optimal mix of timber from various stem shapes. 2-a. This percentage may sound disturbingly low, but researchers say it is not surprising given the limits of FRI technology and other factors. 3-b. McLaughlin was the expert behind five indicators focusing on compliance with water quality guidelines and fish guidelines, nitrogen and sulphur cycling, and snowfall and temperature trends. For more about these topics, see *Insights*, Vol. 8 No. 1 at ontario.ca/ofri.

Research busts myth about effects of boreal silviculture on plant diversity

A paper published in the journal *Biodiversity Conservation* challenges the notion that boreal silviculture practices such as clearcutting, site preparation, planting species, and spraying herbicides lead to monocultures, reports OFRI's Wayne Bell.

Want to learn more? E-mail information.ofri@ontario.ca or call the OFRI publication request line at (705)946-2981, ext. 271, and ask for *Do Tree-Level Monocultures Develop Following Canadian Boreal Silviculture? Tree-Level Diversity Tested Using a New Method*. Please specify electronic (PDF) or paper.

Jason Dampier and Nancy Luckai of Lakehead University, Bill Towill of MNR's Northwest Science and Information, and Bell collaborated on the study. All the data came from projects begun under MNR's Vegetation Management Alternatives Program.

Farewell to **Fraser Dunn,** who was director of MNR's Applied Research and Development Branch and an OFRI resident for seven years. Dunn, who retired last spring, oversaw forest, aquatic, and wildlife research units in Sault Ste. Marie, Thunder Bay, and Peterborough, Ontario. He worked for MNR for more than 30 years, and his accomplishments included leading the ministry's high-profile Lands for Life and Ontario's Living Legacy programs and being a key member of the team that developed the historic *Ontario Forest Accord*. He also held positions in district offices and in MNR's aviation and forest fire management programs.

Manager **Wayne Fiset** has returned to his position at OFRI after an acting assignment as executive assistant to Bill Thornton, assistant deputy minister of MNR's Forests Division. He reports, "What I learned in this acting assignment will contribute to forging even stronger links between MNR's forest research and management units, the latter of which rely on the former to help ensure a strong scientific foundation for MNR's policy, planning, guides, and operations." Contact Fiset at (705)946-7482, wayne.fiset@ontario.ca.

Paul Ward, who sat in for Fiset as OFRI manager during this time, says that working at OFRI was challenging and enjoyable: "It was a great experience working with such dedicated managers and researchers and to learn more about the range of applied forest research they are leading." Ward is now working on a special climate change assignment for MNR's science and fire management organizations.

Ed Cappelli is OFRI's new operations management leader, replacing the recently retired Connie Bouffard. Previously, he was a property manager with Ontario Realty Corporation, providing facilities management for special-purpose tenants such as the Ontario Provincial Police, two forensics labs, a public health lab, and OFRI. At OFRI, he is overseeing building operations, administrative support, and technology transfer. Contact Cappelli at (705)946-7403, ed.cappelli@ontario.ca.

Jiaxin Chen is OFRI's new impacts and adaptation research scientist. Jiaxin received a PhD in engineering and information systems from Leeds Metropolitan University in England in 2001. He then worked as a post-doc at Lakehead University for a year and a half. Prior to landing his new scientist position, Chen was a carbon budget modeller at OFRI. Chen reports that in both of these positions he has been "fortunately and unfortunately" working with colleagues Steve Colombo and Michael Ter-Mikaelian to develop a carbon budget model for Ontario: "fortunately, because it is an interesting and timely area of research and unfortunately because my colleagues had to work with someone who was a beginner in forestry." His colleagues point out that this statement reflects his humble nature and sense of humour but not his high level of achievement. Contact Chen at (705)946-7486, jiaxin.chen@ontario.ca.

Trevor Jones is OFRI's new hardwood ecosystem research scientist. A 2006 PhD graduate of the University of Toronto (UofT), Trevor is a field ecologist/ecophysiologist who is interested in forest disturbance dynamics. At UofT he studied the effects of selection management on the physiology and growth of tolerant hardwoods. He comes to OFRI from the University of British Columbia's Geography Department, where he was investigating the spatial and temporal dynamics of coarse wood in small streams. His research at OFRI will focus on the effects of management on residual forest structure and species diversity as well as the restoration and recovery of degraded forests. He has been meeting with a range of clients and partners to further assess hardwood research needs and priorities for Ontario and to map out the future of MNR's hardwood research program. He has also been tossing around some ideas for research on the effects of removing forest biomass for biofuel production and has been helping to lead the latest phase of a study on coarse wood in shoreline ecosystems begun by his predecessor. Contact Jones at (705)946-7487, trevor.jones2@ontario.ca.

Bill Cole, who preceded Jones as OFRI's hardwood scientist, is now a science management coordinator at OFRI, working with biochemistry, soil/water, modelling, genetics, and landscape ecology researchers. During his 15 years as a scientist, he worked on long-term ecological and tolerant hardwood projects and reports that his research highlights include discovering 1,000-year-old logs in Algonquin Park as part of a shoreline coarse wood/fish habitat study, assembling all known Ontario hardwood studies into a

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meta-database and annotated bibliography, producing a 20-year management plan for OFRI's historic Swan Lake Forest Research Reserve in Algonquin Park, and conducting studies on partial harvesting in old growth white pine, large-scale photography, and single-tree selection harvesting in sugar maple. He also led a team of OFRI staff in producing tree ring evidence that spurred a local timber thief to plead guilty, resulting in Ontario Provincial Police commissioner's commendations for him and his research team. Cole says he misses the thrill of scientific discovery but likes being able to interact with a broader range of people and projects as a manager. Contact Cole at (705)946-7408, bill.cole@ontario.ca.

Wenbin Cui is now the senior landscape ecology analyst with OFRI's Forest Landscape Ecology Program (FLEP), led by Ajith Perera. His work involves analyzing and modelling spatial patterns of Ontario's forest landscape dynamics and fire disturbance regimes. Previously, he was a contract research scientist with FLEP working on fire regime modelling. In his new position, he is continuing to apply his fire modelling expertise to projects such as spatio-temporal analysis of boreal forest fire size distribution and the BFOLDS fire simulation module (see related article in this issue). Much of his work has supported Condition 39c of the *Declaration Order Regarding MNR's Class Environmental Assessment Approval for Forest Management on Crown Lands in Ontario*. Cui has a PhD in forest engineering from Beijing Forest University in China. Contact Cui at (705)946-7429, wenbin.cui@ontario.ca.

Jennifer Dacosta is the new forest research ecologist working with the Forest Ecology Program at OFRI, led by research scientist Wayne Bell. She is working on several projects, most notably the *Intensive Forest Management: NEBIE Plot Network* project, which focuses on testing a range of silvicultural intensities in various forest types across northern Ontario with the goal of increasing forest productivity. Jennifer has an MSc in forest conservation from the University of Toronto. Previously, she was working on data and geospatial analysis at the Canadian Forest Service-Great Lakes Forestry Centre; however, she has worked with Wayne Bell before in contract positions. Contact Dacosta at (705)946-7416, jennifer.dacosta@ontario.ca.

Sandra Wawryszyn, coordinator for OFRI's Soil and Water Research Program, has taken an acting assignment with MNR's Forest Policy Section. **Ngaire Eskelin** is filling Wawryszyn's shoes in the interim. Eskelin received her BSc in environmental science-forest conservation from Lakehead University and also has an MSc in environmental science from Memorial University. She has worked for OFRI before, providing technical support to Wayne Bell and the Forest Ecology Program. Contact Eskelin at (705)946-7485, ngaire.eskelin@ontario.ca.

John McLaughlin, OFRI's research pathologist, recently returned from an educational leave at the University of Guelph, earning a PhD in forest pathology. His thesis focused on *Abiotic and Biotic Factors Associated With Pocket Mortality of Red Pine (*Pinus resinosa *Ait.) in Southern Ontario.* Contact McLaughlin at (705)946-7419, john.mclaughlin@ontario.ca.

Wayne Bell has begun an educational leave to work on a PhD at the University of Guelph. His research will focus on tradeoffs between fibre production and biodiversity in even-aged silvicultural systems in the boreal forest.

Maara Packalen, a biochemical lab technologist who works with tree biochemistry research scientist Tom Noland and soil and water research scientist Jim McLaughlin, recently earned her MSc in biological sciences from Michigan Technological University. Her thesis, entitled *Microbial Hydrolytic Activity in Northern Ontario Peatland Stream Sediments With Varying Organic Matter Concentration*, examined factors related to organic matter hydrolysis, a rate-limiting process in organic matter decomposition. This study provided insight into the contribution of northern stream sediments to peatland carbon dynamics and is particularly relevant to consideration of intensified harvesting of forested wetlands, alternative energy pursuits, and climate change-related pressures. Contact Packalen at (705)946-7447, maara.packalen@ontario.ca.

Dave Niblett, a long-time research technician with the Boreal Mixedwood Research Program, has left OFRI to become a forester in New Brunswick.

Insights
A publication of the Ontario Forest Research Institute

Have a suggestion?

Want more information on a research project?

We want to hear from you!

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(or the specific OFRI researcher)

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